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University of Cambridge
School of Agriculture Memoirs

Memoir No. 5

A brief summary of the papers published by
the Staffs of the School of Agriculture and
its Associated Research Institutes during
the period May 1st, 1932—April 30th, 1933.



1933

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FOREWORD

This Memoir, which is published under the general editorship of the Librarian of the School, represents an attempt to present as succinctly as possible the contributions made by members of the Staffs of the School of Agriculture and its Associated Institutes to the development and progress of Agricultural Science, and to indicate to research workers interested the Journals in which the full papers are presented. Each summary is compiled by the author of the paper summarized and is presented, so far as the subject matter will allow, in a non-technical form in order to be of value to the general body of farmers interested in the more recent developments of agricultural scientific research in general and of the activities of this Department in particular.

Requests for further information or criticism arising out of the summaries should be referred to the individual author concerned, criticisms and suggestions for the improvement of the Memoir itself should be addressed to the Librarian of the School.

E. T. H.



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Members of Staffs, summaries of whose papers are included in these
Memoirs.

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School of Agriculture Memoirs

THE SCHOOL OF AGRICULTURE INCLUDING ESTATE MANAGEMENT, THE ADVISORY SERVICES AND ASSOCIATED RESEARCH INSTITUTES

Agricultural Education in Cambridge dates from 1892 when the Cambridge and Counties Agricultural Education Committee, an informal body consisting of University Professors and County Council representatives, first organized an Agricultural Course. In 1899 the University created a Department of Agriculture to take over the work of this Committee. The School of Agriculture was built by public subscription in 1909 and expanded by a grant from the Development Commission in 1912. The Estate Management branch has been added since the war for the purpose of providing technical and professional assistance in the management of University and College property and with a view to affording opportunities for practical demonstrations in connection with the teaching of Estate Management subjects.

The buildings of the School were enlarged for the further accommodation of the Research Institutes largely by a grant from the Development Commission in 1925-26, and the new buildings provide in addition an enlarged Library and rooms for the Estate Management branch.

The School of Agriculture, while primarily a teaching department of the University, carries out research in problems of agriculture and cognate sciences through members of its staff and the staffs of the Research Institutes attached to it.

AGRICULTURE.

“Elements of Agriculture.”

Ed. by the late W. Fream. 12th Edition ed. by Prof. Sir R. H. Biffen. Pp. VIII + 720, with 15 Plates and 132 Figs. 10/6 net. John Murray, London, 1932.

The following members of the School contributed to this work:—A. Amos, R. H. Biffen, D. Boyes, F. L. Engledow, F. H. Garner, E. T. Halnan, J. Hammond, H. Hunter, W. S. Mansfield, F. H. A. Marshall, H. H. Nicholson, H. G. Sanders, C. Warburton, A. E. Watkins, and H. E. Woodman.

MANSFIELD, W. S.

“Notable Farming Enterprises. II. The Farms of Messrs. Chivers and Sons, Ltd., Histon, Cambs.”

J.R.A.S.E., 1931, 92, 142.

AGRICULTURAL CHEMISTRY.

WOOD, T. B.

“A Course of Practical Work in Agricultural Chemistry for Senior Students.”

2nd ed., rev. by H. H. Nicholson. Pp. 56. 2/6. Camb. Univ. Press, 1932.

AGRICULTURAL ECONOMICS.

“An Economic Survey of Agriculture in the Eastern Counties, 1931.”

(Farm Econ. Branch Report, No. 19). Pp. 90. Price 2/6 net. Postage 3d.

This survey, essentially an *interim* Report, examines the economic position of agriculture in the eastern counties during 1931, and is largely descriptive in character. It is mainly concerned in determining the nature and extent of the agricultural problem, and in providing the background of detail essential to constructive action. In Chapter II the financial and economic data are dealt with under three headings, viz.: (1) Provincial averages, (2) Size group averages, and (3) “District” group averages. For the year under review it would have been necessary for the price level of farm produce to have been 18 per cent. higher than it actually was (costs remaining constant) in order to provide occupiers with interest at 5 per cent. on their capital and a cash wage of 48/- per week for their manual and managerial work. Although the eastern counties form the principal corn producing area of England, sales of cereals represented only some 14 per cent. of the gross income. These figures varied largely with different sizes of farm, and in different farming “districts,” and comparisons of these, and other factors of importance, are made in the two latter sections of the chapter. Chapter III deals with livestock enterprises, of which dairying is the most important. The position of crops is considered in Chapter IV, where it is pointed out that more than two-thirds of the total farmed area in the Province is devoted to the production of fodder for livestock. In Chapter V costs of production are discussed,

while Chapter VI deals with farm equipment, size of fields, drainage, and other matters. Chapter VII is devoted to a discussion of the principal farm management factors influencing profitability on the individual farm. Statistical data are provided in an Appendix.

“ Interpretation of Farm Accounts.”

(Farm Econ. Branch. Farmers' Bulletin, No. 1). Price 6d. Post Free.

This bulletin is designed for farmers, and outlines a technique for interpreting farm accounts, with a view to securing information on managerial efficiency. Certain factors appear to be of special importance at the present time, the most general of which are :—

(1) The efficiency of the labour organisation measured in terms of the gross farm output per £100 worth of labour.

(2) The rate at which the farm capital is turned over.

(3) The efficiency of livestock production measured in terms of the gross livestock output per £100 worth of foods.

(4) The size of the farm measured in terms of the gross farm output.

The significance of these measures is illustrated in the following table, which compares the average return (profit = (+), loss = (—)) realised in 1931 by those farms which were below the group “ standard ” in each of the four factors, with that obtained on farms above “ standard ” in one or more of the factors :—

Size of farm.	Average profit surplus per farm on holdings.				
	below “ Standard ” in all 4 factors.	above “ standard ” in factor—			
		1	1 and 2	1, 2 and 3	1, 2, 3, and 4
(acres)	(£)	(£)	(£)	(£)	(£)
20-50	(—) 184	(—) 9	(+) 20	(+) 97	(+) 146
50-100	(—) 294	(+) 4	(+) 44	(+) 119	(+) 134
100-150	(—) 337	(+) 27	(+) 96	(+) 143	(+) 205
150-300	(—) 492	(+) 38	(+) 138	(+) 224	(+) 257
Over 300	(—) 906	(+) 61	(+) 207	(+) 337	(+) 461

“ Standards ” for the different factors in each size group are suggested, and the method of calculation explained. The final pages describe how advantage may be taken of deductions made by the analyses, and a blank budget form is incorporated.

“ Financial Results of Farming in the Eastern Counties of England : Preliminary Statement for 1932.”

(Farm Econ. Branch. Farmers' Bulletin, No. 2). Price 6d. Post Free.

The year 1932 has been, like its predecessor, most unprofitable for farmers in the eastern counties of England. The most outstanding features on the income side have

been the heavy fall in livestock prices, the poor market for the 1932 barley crop, and the provision of "deficiency payments" under the Wheat Act, 1932. Of the two important items of cost, wage rates have remained practically constant, while the cost of feeding stuffs has hardened considerably from the low level ruling in 1931.

The bulletin compares changes in valuation, gross incomes, gross charges, and profitableness in different sizes of farms between 1931 and 1932. But for the wheat "deficiency payments" profits for 1932 would have averaged minus £37 per farm, or £45 less than the very low figure of 1931. To express this in another way, it would have been necessary for prices secured for 1932 produce to have been 25 per cent. higher than they actually were in order to provide a fair return (excluding private drawings in kind) on the capital invested and for the work of the occupier.

CARSLAW, R. MCG.

"Size of Fields in the Eastern Counties of England."

Farm Econ. 1933, I, 36.

A random sample of some thousands of fields in the eastern counties shows that at the present time the average size of arable fields throughout the Province is just over 10 acres. There is, of course, considerable variation, not only between farms of different sizes, but also between different districts. This note describes these variations, and suggests their influence on mechanised methods of production.

CARSLAW, R. MCG.

"Financial Results of Farming in the Eastern Counties of England in 1932."

Essex Farmers' J., Feb., 1933, and Herts. Milk Record. Soc. Ann. Rept., 1933.

CARSLAW, R. MCG.

"Economic Investigation of Farm Management Problems."

Agric. Prog. 1933, 10, 13.

This is a contribution towards a symposium by a number of British Agricultural Economists on the progress of research in farm economics. It outlines scope and method, and describes some of the objectives and difficulties of this comparatively modern branch of applied research.

CARSLAW, R. MCG. AND MENZIES-KITCHIN, A. W.

"Effect of the Wheat Act, 1932, on Production."

Farm Econ. 1933, I, 17.

This note attempts to estimate the effect on wheat acreage, on the quantity of wheat sold, and on farm receipts for wheat in 1932 and 1933, of the provisions of the Act.

COHEN, RUTH L.

"The Effect of Different Price Policies on the Seasonal Production of Milk."

Farm Econ. 1933, I, 14.

Since 1922-23, when the National Farmers' Union first negotiated milk prices with the National Dairymen's Federation, the Permanent Joint Committee has adopted three different methods of paying the farmer. This article shows how these different methods may affect the production of milk at different times of the year.

MENZIES-KITCHIN, A. W.

"The Profit Margin in the Pig Re-organisation Commission's Price Formula."

Farm Econ. 1933, I, 25.

That the price formula suggested in the Commission's Report is inadequate is widely acknowledged. This article deals critically with certain assumptions, both practical and scientific, of the Commission, which largely invalidate the utility of the formula.

AGRICULTURAL ZOOLOGY (including ENTOMOLOGY).

240* PETHERBRIDGE, F. R. AND THOMAS, I.

"The Control of the Raspberry Beetle."

J. Min. Agric. 1933, 39, 1017.

Experiments conducted in the Isle of Ely, Huntingdon and Essex show that dusting with a Derris dust (containing 0.2 per cent. of rotenone) first, when the beetles are feeding on the developing flowers and new shoots, and again when the flowers begin to open, is the most satisfactory means known at present of reducing the damage done to loganberries by the raspberry beetle. The experiments also show that a good control of the beetle on loganberries can be obtained by spraying with Soft Soap and Derris (0.2 per cent.) about 10 days after full bloom and again about 10 days later. The latter method also gave a satisfactory control of this pest on raspberries. Soft soap and nicotine sulphate (10 oz. to 40 gal. of water) used at the same time gave equally good results. The cost of these two washes is practically equal but it should be borne in mind that nicotine sulphate is a standard article, whereas Derris powder is a product that may vary in its composition.

ANIMAL BREEDING AND GENETICS.

220* EDWARDS, J.

"Breeding for Milk Production in the Tropics."

J. Dairy Sci. 1932, 3, 281.

The influences of age and service period upon the milk yields of dairy cattle in Jamaica are examined and correction factors to a mature yield are evolved. The inheritance of milking capacity is examined on a "percentage of Zebu blood" basis, it being found that the European group (with no Zebu blood) possess a low average yield and a high percentage of constitutional failures. Its representatives have the inheritance to produce milk but lack the constitution to express their inheritance. The group with 50 per cent. Zebu blood has a similar average yield and an equally high percentage of non-producers which in this case might be termed constitutional failures. The group possesses constitution but lacks the factors for a better milk inheritance and docility. The desirable combination of the higher yields with the lower percentages of failures appear in the grades between the two extremes. This fact suggests that from them a strain best suited to the environment might be developed. It is conceivable that under conditions tropically more severe than those of Jamaica it may be desirable to have more Zebu and less European blood.

EDWARDS, J.

"The Breed Society and the Progeny Test."

Dairy Shorthorn J., 1933, 2, No. 1., and the Jersey Cow, 1933.

A discussion of the value of the progeny test to the pedigree breeder ; the need for fuller information in pedigree systems is emphasised and the worth of systematic progeny-recording through the Milk Recording Societies as a supplement to the existing Advanced Registers or Register of Merits is stressed. The *unselected* progeny of a much greater number of pedigree sires will automatically be recorded and the Breed Society's Office will become the clearing house of information on "proved" sires or progeny-tested stock.

EDWARDS, J.

"The Inheritance of Milk Capacity."

Nature, 1932, 129, 437, 867.

A discussion of methods adopted and evidence advanced elsewhere in support of a sex-linked hypothesis for milk-yield.

231* EDWARDS, J.

"The Progeny Test as a Method of Evaluating the Dairy Sire."

J. Agric. Sci. 1932, 22, 811.

A survey of environmental and physiological factors influencing milk yield and an analysis of theories of, and experiments on, milk and butterfat inheritance are given. Further evidence is provided of the fact that the proved dairy sire is the outstanding medium through which improvement in dairy cattle breeding may be effected. The minimum number of unselected daughters necessary to give a reasonably accurate indication of their sire's transmitting ability is shown to be six. Sire indices are examined for their accuracy in assessing this latter quality, it being found that the average yield of the daughters is the most satisfactory single figure indicator. The importance of making a most thorough investigation of all available information when "proving" bulls is stressed.

250* EDWARDS, J. AND HAMMOND, J.

"A National Scheme for Progeny Recording."

School of Agric., Cambridge, 1932.

A practical scheme for the progeny-recording of dairy bulls in milk-recording herds adopted by the Central Council of Milk-Recording Societies. The scheme can be worked ideally within a county Milk Recording Society ; it provides for the systematic recording of the milk and, where possible, butterfat, and transmitting abilities of sires in use in members' herds. The breeder, the Milk-Recording Society and the Breed Society all stand to benefit from this regular collection of valuable information. Bulls good and bad will be recorded so that strains of high and low producers will be revealed ; and the *unselected progeny* of each sire will be recorded, ensuring information as complete as possible.

251* EDWARDS, J. AND SMITH, J. HUNTER.

"The Importance of the Progeny Test in Dairy Cattle Breeding."
J.R.A.S.E., 1932, 93, 68.

A practical consideration of the value of the progeny test as a method for improving dairy cattle. The progeny records of 51 dairy sires are analysed from the standpoint of milk transmitting ability. The relation between this factor and the desirable state of an entirely self-supporting herd is made clear. Methods for prolonging the lives of potential "proved" bulls are discussed together with the pedigree value of the progeny-record in the selection of a young untested sire.

252* EDWARDS, J.

"The Bull in Your Herd."

Berkshire N.F.U. Year Book, 1933.

EDWARDS, J.

"Case for Proved Dairy Sires."

Farmer and Stock-Breeder and Agric. Gaz. 1932, 46, 1339.

EDWARDS, J.

"Reducing Chance in Selecting Dairy Bulls."

Farmer and Stock-Breeder and Agric. Gaz. 1932, 46, 1555.

HAMMOND, J.

"The Inheritance of Fertility in the Rabbit."

Proc. VIth. Int. Cong. Gen., Ithaca, N.Y., 1932.

By inbreeding, strains with different levels of fertility have been isolated. The causes affecting fertility have been determined: these are (1) the number of ova shed, (2) number of ova fertilized and (3) the number of foetuses which atrophy before birth. Crosses and back crosses have been made between two strains, both of low fertility but for different causes (1) and (3). High fertility is obtained in the F_1 generation: ova number is intermediate and foetal atrophy recessive. Foetal degeneration is a maternal and not a foetal character, and is one of the main causes of lowered fertility on inbreeding. These two characters—foetal atrophy and ova shed—appear to be examples of the two ways in which evolution is proceeding—(1) large mutations producing in the main deleterious forms and fancy varieties, and (2) small variations, the accumulation of which build up economically important characters.

HAMMOND, J.

"Report on Cattle Breeding in Jamaica and Trinidad."

Empire Marketing Board, No. 58. Aug., 1932. (Obtainable from H.M. Stat. Office, London. Price 1/3. Post Free).

A general account is given of the methods of cattle production, and the particular problems of milk production in the tropics are discussed. Various methods which have been tried to improve dairy cattle in the tropics are described, and it is suggested that a new breed of cattle suitable for tropical conditions might be designed from crosses between British breeds, supplying the udder development, and the Zebu, supplying the "constitution" suited to tropical conditions.

HANLEY, F.

"The Eastern Provincial Cockerel Breeding Scheme."

Essex Agric. Comm. Register of Egg Records . . . 1931-32.

Describes the objects of this Scheme. Details are given of the working of the Scheme followed by an account of the results obtained in the first two seasons.

MANSFIELD, W. S.

"Getting Real 'Dual-Purpose.'"

Farmer and Stock-Breeder and Agric. Gaz., 1933, 47, 19.

MARSHALL, F. H. A., AND HAMMOND, J.

"Fertility and Animal-Breeding."

3rd ed. Amended. Bull. 39, Min. of Agric. and Fish., 1933. (Obtainable from H.M. Stat. Office, London. Price 1/8. Post Free).

ANIMAL NUTRITION.

CRUICKSHANK, E. M.

"Recent Research Work in Poultry Nutrition."

Harper Adams Utility Poultry J., 1932, 17, 626.

This paper refers to the work at present being carried on in Cambridge on the fat metabolism of fowls. The problems under investigation are :—

(1) What is the nature of the fat deposited in the body and in the egg from the normal cereal rations?

(2) Is fat from the food transferred to the body fat and the egg without change? If this is so, the quality and nature of both the carcase and the egg will be affected by feeding.

It has been found that the nature of the food will influence considerably the composition of the body fat; the ingestion of fats, either animal or vegetable, of low iodine value, i.e. saturated fats, will lower the iodine value of the body fat considerably, while the feeding of unsaturated fats, e.g. hemp seed oil, will raise the iodine value.

In the case of the egg it has been found that fats of a highly unsaturated nature can be readily introduced into the yolk making the yolk fat more unsaturated than normal. On the other hand it seems very difficult to make the yolk fat more saturated than normal. The possible relationship of this fact to hatchability is briefly discussed.

EDWARDS, J.

"Research and Experimental Work in Pigs, 1931."

N.P.B.A., 1932-33, 12, 58.

A summary of the preceding year's pig research at Cambridge.

EVANS, R. E.

"The Mineral Requirements of Pregnant Sows."

J. Min. Agric. 1932, **39**, 544.

A suitable mineral mixture for pregnant sows (not having access to milk by-products, fish meal or good grazing) should contain chalk and common salt in the proportion of four parts of the former to one part of the latter. It should be fed at the rate of 1 oz. per day.

During lactation $2\frac{1}{2}$ oz. of the mineral mixture would be required per head daily. No phosphate supplement is required.

GARNER, F. H.

"Feeding the Cows in the Cambridge University Shorthorn Herd."

Dairy Shorthorn J. 1933, **2**, No. 2.

A full account is given of the feeding of the cows in the non-pedigree dairy shorthorn herd at the University Farm, Cambridge. The article deals with the feeding of high yielding cows; the herd average for the milk recording year ending 1st October, 1932, was 1233 gallons. The feeding of the cows in the dry period is explained in detail since it has a profound influence on the milk yield obtained during the subsequent lactation. After calving the aim is to "lead" the milk yield up by feeding slightly above production requirement till the maximum daily milk yield is produced, and then to reduce the quantity of concentrates fed daily in conformity with the fall in milk yield.

GARNER, F. H.

"Minerals for Dairy Cows."

Off. Yearb. Cambs. Milk Record. Soc. 1931-32.

(Repr. in the following Milk Record. Soc. Yearbooks:—Leicestershire and Rutland; Monmouthshire and Breconshire; Northamptonshire; Oxfordshire; Surrey; and Warwickshire.)

The importance of feeding calcium and phosphates in the concentrated ration of both milking and dry dairy cows is emphasised. Cows should have access to salt licks, which, on most farms, may be most conveniently supplied in the form of rock salt; in only a few areas are iodised salt licks necessary.

HALNAN, E. T.

"Scientific Principles of Poultry Feeding."

2nd ed. Bull. No. 7, Min. of Agric. and Fish. 1932. (Obtainable from H.M. Stat. Office, London. Price 9d. Post Free).

HALNAN, E. T. AND CRUICKSHANK, E. M.

"On the Suitability of Palm Oil as a Mutton-Fat Substitute for Poultry Fattening Mixtures."

Bull. Imp. Inst. 1932, **30**, 312.

A report on the value of palm oil for use in poultry fattening. Experimental evidence is adduced to show that this substance is suitable for use in poultry fattening mixtures and does not affect adversely the quality of the carcass produced.

WOOD, T. B.

“Rations for Live Stock.”

7th ed. rev. by H. E. Woodman. Bull. No. 48, Min. of Agric. and Fish. 1932.
(Obtainable from H.M. Stat. Office, London. Price 1/2. Post Free).

WOODMAN, H. E.

“Bone Charcoal as a Source of Minerals for Farm Animals.”

J. Min. Agric. 1932, **39**, 403.

A paper dealing with the possibility of using bone charcoal, a by-product of the sugar refineries, as a cheap substitute for feeding bone flour in the mineral supplements of farm animals.

223* WOODMAN, H. E. AND EVANS, R. E.

“The Value of Degermed Maize Meal (Cooked) in the Nutrition of Swine.”

J. Agric. Sci. 1932, **22**, 670.

This feeding stuff is shown to be equal, in respect of digestibility, to such highly digestible foods as tapioca flour and flaked maize and significantly superior to whole maize meal and barley meal. On account of its low oil content, it should be capable of being employed liberally, in the rations of porkers and baconers right up to the date of slaughter, and in this respect, therefore, possesses an advantage over both whole maize meal and flaked maize.

222* WOODMAN, H. E., EVANS, R. E. AND MENZIES-KITCHIN, A. W.

“The Value of Oats in the Nutrition of Swine.”

J. Agric. Sci. 1932, **22**, 657.

An investigation, by means of digestion trials and farm-feeding trials, into the feeding value of oats in varying degrees of fineness when employed in partial replacement of barley meal in the rations of bacon pigs.

230* WOODMAN, H. E. AND NORMAN, D. B.

“Nutritive Value of Pasture. IX. The Influence of the Intensity of Grazing on the Yield, Composition and Nutritive Value of Pasture Herbage (Part IV).”

J. Agric. Sci. 1932, **22**, 852.

A continuation of the Cambridge pasture investigations, in which are examined the consequences of the adoption of a 5-weekly rotational close-grazing system on the nutritive properties of pastures.

221* WOODMAN, H. E. AND STEWART, J.

“The Mechanism of Cellulose Digestion in the Ruminant Organism : III. The Action of Cellulose-splitting Bacteria on the Fibre of Certain Typical Feeding Stuffs.”

J. Agric. Sci. 1932, **22**, 527.

This paper deals with the results of quantitative investigations into the fermentation of the fibre of certain feeding stuffs by means of thermophilic cellulose-splitting bacteria. The primary object was to ascertain whether such measurements could

form the basis of a quick *in vitro* method for estimating the digestibility of the fibrous constituent of feeding stuffs and, in addition, could lead to a method for following the process of lignification in herbage and forage crops.

WOODMAN, H. E.

"Home-Grown Feeding Stuff."

2nd ed. Bull. No. 13, Min. of Agric. and Fish. 1933. (Obtainable from H.M. Stat. Office, London. Price 7d. Post Free).

WOODMAN, H. E.

"Fish Meal as a Food for Live Stock."

Bull. No. 63, Min. of Agric. and Fish. 1933. (Obtainable from H.M. Stat. Office, London. Price 9d. Post Free).

ANIMAL PHYSIOLOGY.

246* ASDELL, S. A. AND HAMMOND, J.

"The Effects of Prolonging the Life of the Corpus Luteum in the Rabbit by Hysterectomy."

Amer. J. Phy. 1933, 103, 600.

By removing the uterus the life of the corpus luteum is prolonged for a period of about 10 days. This however does not cause pregnancy development of the mammary gland, which is probably due to an extra-ovarian substance.

234* HAMMOND, J.

"Le développement de la sécrétion lactée."

Vol. Jubilaire à l'honneur du Prof. Ch. Porcher, Chamberg, 1932.

The changes taking place in the structure and the amount and composition of the secretions of the udder of the cow during the inception of lactation in the individual are outlined. It is suggested that differences in the composition of milk in various species can be described as stages in evolution, and correspond with the differences in the composition of the milk of the cow which take place during the inception of lactation in the individual. The lactation curve, which is usually shown as a down slope only, has also an up slope which rises slowly during the latter part of pregnancy and, under optimum conditions of feeding, attains its maximum about 6 weeks after calving. The up curve and the height to which it rises depends on the factors affecting the growth of the mammary gland.

HAMMOND, J.

"Recent Advances in Agricultural Physiology."

Sci. Prog. 1932, 27, 227.

A summary of some recent work on milk production under the following headings:—Growth of the udder; the mode of milk secretion; factors affecting yield; feeding; the blood in relation to milk secretion; milk composition; feeding value of milk; the life of the dairy cow; inheritance of milk production; and tropical dairying.

227* MARSHALL, F. H. A.

"Recent Research on the Sex Hormones and their Cyclical Production."

Brit. Med. J. Aug. 6th, 1932.

In this paper the author gives, in a concise and clear manner, the present state of our knowledge with regard to the sex hormones. The testis is shown to produce a hormone "proviron" which has the empirical formula $C_{16}H_{26}O_2$ and which is associated with the development of the secondary male characters. The female generative organs give rise to two hormones, the "folliculin" or "oestrin" of the ovary, which plays an important part in the control of "heat" and the "progesterin" of the corpus luteum, which is an essential factor in maintaining the raised nutrition of the uterus during pregnancy and the promotion of mammary growth in preparation for milk secretion. The anterior lobe of the pituitary also produces two sex-hormones which have a functional correlation with the two ovarian hormones "oestrin" and "progesterin." Evidence postulating a physiological antagonism between the internal secretion of the posterior lobe of the pituitary and that of the corpus luteum, is presented.

MARSHALL, F. H. A. AND HALNAN, E. T.

"Physiology of Farm Animals."

Pp. XIV + 366, with 118 Plates and Diagrams. Price 15/- net. Camb. Univ. Press, London, 1932.

This book is primarily intended for students of agriculture who wish to obtain some knowledge of the processes of physiology as they occur in the domestic animals, as well as to act as a guide to the modern science of animal nutrition. It is hoped that it will also prove of service to veterinarians and others interested in animal physiology. The book covers a wide field, and deals with the histology of the main tissues and organs of the body, the physiology and chemistry of digestion, energy and protein metabolism, the metabolism of the ash constituents and the physiology of reproduction in the domestic animals. Chapters are included on growth, vitamins, heredity and sex, response of the body to injury and disease, and feeding standards. The facts given are presented in as simple a manner as the subject matter will allow, and, as would be expected from a world-wide authority on the physiology of reproduction, the section dealing with this subject is ably presented and up-to-date.

ANIMAL PRODUCTION.

253* EDWARDS, J.

"A New Service from Milk-Recording."

Philip Palmer Series of Milk Record. Soc. Year Books, 1931-32.

236* GARNER, F. H.

"A Study of Some Points of Conformation and Milk Yield in Friesian Cows."

J. Dairy Res. 1932, 4, 1.

Some 461 Friesian cows were measured in Minnesota, U.S.A. and coefficients of correlation were calculated between 19 different body measurements and milk

yield. Coefficients of correlation that were over six times their respective probable errors were taken to be significant ; on this basis the following significant correlations were obtained :—

- Length from withers to pins and milk yield ;
- Length from withers to hooks and milk yield ;
- Height at hooks and milk yield ;
- Height at pins and milk yield ;
- Circumference of chest and milk yield ;
- Circumference of barrel and milk yield ;
- Area of milk wells and milk yield.

In addition, coefficients of correlation were over five times their respective probable errors for width at barrel and milk yield and width at hooks and milk yield, and were considered to be almost significant.

The study of sizes of milk wells was extended and it was shewn that their area was not associated with the mere size of cow but with milk yield only.

Finally, it was pointed out that a cow must not be judged on one point only but by taking a series of points together.

HAMMOND, J.

“ Carcase Competitions and Trade Needs.”

Farmer and Stock-Breeder and Agric. Gaz. 1932, **46**, 2560.

A short illustrated account of the type of carcase in demand, and the interactions of breed and methods of feeding in producing it.

257* HAMMOND, J.

“ Pigs for Pork and Pigs for Bacon.”

J.R.A.S.E. 1932, **93**, 131.

A short popular account outlining the trade requirements as regards weight and quality in pork and bacon pigs. Price curves for animals of different weights are given, and differences between pork and bacon types in the change of body and tissue proportions with increase in weight are illustrated by photographs and diagrams. Pork types are those which go through the changes in the proportions of the body rapidly and so are fit for slaughter at small weights, whereas bacon types go through these changes more slowly ; breeds can be classified on this basis. Proportions of the body can be modified by selection and by methods of feeding. The advantages of Pig Recording as a method of improvement are pointed out.

HAMMOND, J. AND EDWARDS, J.

“ Scientific Aspects of Mutton Production.”

Rep. Brit. Assoc. Adv. Sci. 1932.

Requirements are discussed in the light of present economic conditions, special attention being directed to methods whereby income per ewe might be increased particularly by more intensive production and more rapid returns. Aspects dealt with are :

I. Fertility of the ewe, how it may be improved by breeding and selection for the twinning character, and by feeding or flushing before conception for an increase in the number of eggs shed. The opinion is advanced that an attempt must be made

to secure more than one crop of lambs in the year, resulting in a greater return per ewe and a better seasonal distribution of the lamb supply.

II. The growth of the lamb after birth is considered. Emphasis is laid on the need for a continuous and good milk supply, the avoidance of a check in growth during the early stages of development, and the provision of young succulent protein-rich forage.

III. The development of mutton qualities is discussed. A study of the differing rates of growth of the various parts of the animal's body provides a scientific explanation of the term "early maturity," and the process by which this quality can best be achieved is seen to be a consistently high plane of feeding. Such treatment not only satisfies market requirements but also reveals genetic capabilities, pointing to strains either possessing or lacking the characters sought.

235* WOODMAN, H. E. AND EVANS, R. E.

"Cystine and Wool Production."

Nature, 1932, 130, 1001.

It is shown that there is no difficulty in accounting for wool production, under English systems, in sheep subsisting wholly on pasturage. The cystine content of the herbage, although apparently low, is adequate for this purpose. The previous interpretation of the figure obtained for the cystine content of grass as indicating the presence in the herbage of a cystine precursor becomes therefore superfluous (*See* Memoir 4, p. 14.)

HORTICULTURAL CHEMISTRY.

229* WOODMAN, R. M.

"Wetting, Spreading, and Emulsifying Agents for Use with Spray Fluids. III. Emulsifiers, and Soaps containing Spraying Oils."

J. Soc. Chem. Ind. 1932, 51, 358T.

The effect of mechanical violence in the preparation of spray stock emulsions is demonstrated. Linseed products are shown to be unsuitable spray emulsifiers. General formulae for preparing moderately stable soaps containing insecticidal and ovidical oils and spray substances such as naphthalene are given; these soaps yield perfect, stable, oil-in-water emulsions of the oils on soaking in water with subsequent shaking, but the percentage of toxic oil which can be so held is probably too low to advocate the general use of these soaps.

237* WOODMAN, R. M.

"Wetting, Spreading, and Emulsifying Agents for Use with Spray Fluids. IV. Miscible Oils."

J. Soc. Chem. Ind. 1933, 52, 4T.

The standardisation of the toxic oil in spray emulsions is discussed. Fusel oil may replace phenols as an aid to dissolution in the preparation of a miscible oil. The miscible oil-forming tendency of various mixtures of fusel oil and soap has been measured and the character of the emulsions from these miscible oils studied. The effect of incorporation of resin oil and of water has also been investigated.

PHYSICAL CHEMISTRY.

239* WOODMAN, R. M.

"Emulsion Systems containing Phenols, Water, and Gelatin."
J. Soc. Chem. Ind. 1933, **52**, 44T.

226* WOODMAN, R. M.

"Note on the True Specific Gravity of Colloid-containing Materials such as the Bentonites."
J. Soc. Chem. Ind. 1932, **51**, 327T.

217* WOODMAN, R. M. AND CHAPMAN, G. W.

"The Behaviour of Clay Gels under Small Pressures, and the Influence of the Exchangeable Base Present."
J. Soc. Chem. Ind. 1932, **51**, 175T.

A simple apparatus has been devised for measuring the swelling of clays under small excess pressures. Capacity for swelling under pressure is found to depend (1) on the total base-exchange capacity of the clay or the $\text{SiO}_2/\text{Al}_2\text{O}_3$ ratio, (2) on the base saturating the clay, and (3) on the age of the clay suspension used in the experiments. A hysteresis or lag effect in subsequent swelling probably occurs on reduction of the pressure to which the clay has been subjected.

238* WOODMAN, R. M. AND RHODES, E.

"Notes on Quebrachitol and the Lipin from Hevea Latex."
J. Rubber Res. Inst. Malaya. 1932, **4**, 153.

Dual types of emulsions are possible with certain oils when the lipin is the emulsifier, and it is noted that with this substance the two types of emulsion can apparently both be present in the same system at one and the same time, the first case of this phenomenon to be recorded up to the present.

Hevea lipin and quebrachitol (1—methyl inositol), two possible by-products from Hevea latex, are demonstrated to be valueless in the spraying industry.

PLANT BREEDING AND GENETICS.

245* BELL, G. D. H.

"The History and Origin of the Cultivated Forms of Barley, and the Classification of the Two Row Barleys of the British Isles."
J. Inst. Brew. 1932, **38**, 371.

This paper is a summary of a more complete work. Mention is made of the archaeological evidence testifying to the great antiquity of barley cultivation, and the question of the origin of cultivated forms is briefly considered.

The main part of the paper deals with the problem of the classification of the cultivated varieties of this country, and a list of grain and vegetative characters is given which can be utilised for purposes of identification.

BOYES, D.

"Vegetable Breeding at the Cambridge Horticultural Research Station."

H. E. A. Year Book, 1932, I, 27.

An article chiefly concerned with a description of the aims of the vegetable breeding work now being carried out by the Cambridge Horticultural Research Station and with a brief account of the methods so far employed in the case of certain vegetables.

The writer emphasises at the outset the importance of plant breeding work in connection with vegetables in view of the higher standard of produce now required by the markets, and in view of the fact that a high degree of uniformity in type is required before experimental work, pathological, chemical, or physiological, can be effectively carried out. He then passes to a statement of problems encountered and of the means adopted in attempts to solve them. The vegetables dealt with in the article are Brussels Sprouts, Broccoli, and Canning Beans.

HUDSON, P. S.

"New Methods of Plant-Breeding: Induced Polyploidy."

J. Min. Agric. 1933, 40, 21.

Emphasis is laid on the growing importance of cytology in general in problems of practical breeding and after a popular explanation of the principles involved, examples are given of fertile hybrids between distantly related species or different genera as a result of chromosome duplication. In continuation attention is called to the possibility under modern experimental conditions of inducing chromosome duplication artificially and it is suggested that wide crossing followed by induced polyploidy may in the future become a successful and rapid method of producing new hybrids, since the hybrids so formed give constant progeny.

HUNTER, H. AND LEAKE, H. M.

"Recent Advances in Agricultural Plant Breeding."

Pp. 361, with 16 Plates. 15/-. Churchill, London, 1933.

This volume which is included in Messrs. Churchill's *Recent Advances Series* is designed to present in a connected form an account of the new crop plants that have been produced by plant breeders in all parts of the world. The progress that has been made in this direction is much greater than is generally realised and it was found impossible to include an account covering the whole ground of breeding activities. Principal crops of temperate and of tropical climates are reviewed and the improved varieties in each case exemplify the application of scientific principles of heredity to modern requirements.

O'CONNOR, C.

"Potato Breeding and Resistance to Blight."

Gardeners' Chron. 1933, 93.

Work on the inheritance of resistance to common blight (*Phytophthora infestans*) in the Potato was started by Dr. R. N. Salaman in 1906. As there was no evidence of any true genetic resistance in seedlings derived from our European stocks, *Solanum edinense* was first used, and later *S. demissum*, a Mexican wild species, was introduced as a source of resistance. These, and other wild species that are highly resistant to blight, have undesirable characters such as low yield, long stolons, deep colour, etc.,

and they may be difficult to hybridise with domestic potatoes. In 1928, Dr. Salaman introduced a method of testing the resistance of young seedlings to blight. They are grown in a glass case and sprayed with a suspension of *P. infestans* spores in water almost daily; conditions are kept as near the optimum for *P. infestans* as possible. The infected seedlings are removed and counted, and the few survivors after they have been sprayed at least 20 times, are potted and when fully grown the leaves are further tested. The most promising of the resistant seedlings are grown the following season and used as parents. It has been found that the F₁ Resistant x Susceptible is generally 100 per cent. susceptible, and if tested as seedlings, they would all be lost. They are therefore planted out, being grown among potatoes infected with virus diseases, and those that become severely infected with virus diseases are eliminated. Many of these seedlings produce heavy yields in their first year but are subsequently crippled by virus infection. Leaves and cuttings of the field plants are tested by artificial infection with *P. infestans*, and during the winter cut pieces of tubers are inoculated in Roux tubes.

Highly resistant varieties with promising economic qualities have already been obtained. The problem has however been complicated by the finding of different biologic strains of *Phytophthora infestans*.

SALAMAN, R. N.

"Report of the Potato Synonym Committee, 1931 and 1932."

J.N.I.A.B. 1933, 3, 193, 198.

PLANT PATHOLOGY.

219* BAWDEN, F. C.

"A Study on the Histological Changes Resulting from Certain Virus Infections of the Potato."

Proc. Roy. Soc., B. 1932, 111, 74.

Evidence is presented showing the occurrence of three distinct types of necrosis in virus infected potato plants, each type being correlated with a definite set of external symptoms. The origin, spread and composition of these necroses is described.

(1) **ACRONECROSIS.**—The external symptoms are a necrotic spotting of the uppermost leaves, followed by the dying of the plant from the top downwards. Internal symptoms are produced in the petioles, stems and tubers, and consist of necrotic changes which originate in the phloem, and spread from thence to all other tissues. In the tuber always, and occasionally in stems grown at high temperatures, phellogens are formed around the necrotic areas.

(2) **ACROPETAL NECROSIS.**—The external symptoms are a crinkling of the upper leaves, and a necrosis and falling of the lower leaves, which, however, remain hanging to the stem. Internal symptoms are seen in the stem and petioles, and consist of a necrosis affecting chiefly the collenchyma, the vascular tissues being normal.

(3) **LEAF ROLL.**—Necroses are produced in the phloem of plants suffering from Leaf Roll in the year following that of infection. The necroses are restricted to the phloem elements, and consist in lignification.

No necroses were found in stems or petioles of virus-free plants.

233* PETHYBRIDGE, G. H. AND SMITH, KENNETH M., 1932.

“A Suspected Virus Disease of Zonal Pelargoniums.”

Gardeners' Chron. 1932, 92, 378.

A suspected virus disease of the zonal pelargonium has been investigated. The symptoms of this disease take the form of pale, chlorotic spots which gradually develop into rounded or more or less stellate blotches. Later, necrosis of the spots sets in and the tissue dries up and becomes brown. This is followed by puckering and splitting of the lamina of the leaf due to unequal growth.

The disease is transmissible by grafting, but the insect vectors have not yet been identified. The virus does not appear to be transmissible by sap inoculation.

This disease has been reported from many parts of England and is very common in the neighbourhood of Cambridge, where it has been causing considerable loss to growers of geraniums.

SALAMAN, R. N.

“Protective Inoculation against a Plant Virus.”

Nature, 1933, 131, 468.

The writer has shown that in a tobacco plant infected with the X potato virus and which exhibited a mottling of large yellow and green areas, strains differing markedly in virulence could be obtained from each. The green areas yielded an inoculum of low, the yellow areas one of a higher degree of virulence. These may be described as the G and L form of X respectively. When healthy tobacco or *Datura* plants were inoculated with the G type, and subsequently inoculated with the L—or indeed with a strain of the very highest virulence—it was found that the latter had no effect and did not appear to have gained an entry. As the protective G infection may result in scarcely perceptible clinical effects the solid immunity against the second inoculation has the appearance of an active immunity. It has been shown that the phenomenon is not humoral but almost certainly a cellular reaction. The protection conferred by inoculation with the G form of X appears to be entirely specific.

218* SALAMAN, R. N. AND BAWDEN, F. C.

“An Analysis of some Necrotic Virus Diseases of the Potato.”

Proc. Roy. Soc., B. 1932, 111, 53.

This paper deals with certain virus diseases of the potato commonly known as ‘streaks.’ A summary of the literature on streak is given, from which it appears that two distinct clinical states can be isolated. One known as stipple-streak or leaf-drop streak and later designated, on the grounds of its histopathology, as acropetal necrosis. The other, known as top-necrosis, described by Quanjer on the basis of its histopathology as acronecrosis.

It has been shown that the former is the distinctive reaction in certain varieties of the Y virus of Kenneth Smith.

Acronecrotic or top-necroses have been shown to be divisible into at least four distinct groups based on their varietal reaction, and here designated as top-necrosis X, top-necrosis A, top-necrosis B, and top-necrosis C.

The first three are alike in that when they do produce a top-necrosis in any given variety, it is unaccompanied by any mosaic symptom. Top-necrosis C, on the other

hand, differs clinically by the fact that necrotic and mosaic symptoms occur together.

The top-necroses X and C complexes are capable of transmission by needle inoculation to other potato varieties, though it by no means follows that the resultant lesion is a top-necrosis. Top-necrosis B is uninoculable, and so is top-necrosis A, except that it can be conveyed to the varieties Arran Crest and Epicure by the needle. This is due to the presence of the X virus as a contaminant of the streak virus.

Carriers of top-necrosis are found amongst many of our widest grown varieties, such as Arran Banner, Majestic and Up-to-date; indeed the latter is rarely to be found without such latent infection.

A carrier of top-necrosis B has only been found in the field in the variety Di Vernon.

A clinical disease, it is held, cannot be defined by the syndrome of its reaction in one particular variety of the potato, but it is to be identified rather by the complete tale of its reactions in a large number of varieties, as well as in a certain number of selected species of the non-related Solonaceae.

The view is put forward that our goal in the study of plant virus diseases and their classification should be to find a correct formula in terms of the virus entities concerned for each clinical disease.

A discussion of the results and their bearing on the theory of virus complexes is added; certain suggestions are put forward for consideration.

The bearing of these results on the raising of crops on an economic basis is considered.

SALAMAN, R. N. AND HURST, C. C.

"Discussion on the Microscopy of the Filterable Viruses."

J. Roy. Micros. Soc. 1932, **52**, 230.

It is well known that intra-cellular inclusions or virus bodies are found in many virus diseases of plants and animals. Use has been made of the potato material resulting from the analysis and synthesis of virus diseases in terms of the specific virus entities X, Y, and Z, and Leaf Roll, to examine the histology and cytology of the leaf laminae with particular reference to such bodies.

Inclusion bodies are only found in potato plants which show some definite symptoms during the season. "Carriers," no matter what virus elements they contain so long as they appear perfectly healthy, are free of inclusions in the leaves.

Plants infected with the X virus, either alone or in combination with other virus elements Y, Z, or Leaf Roll, and presenting symptoms, if not cut at too young a stage, invariably contain inclusion bodies.

Plants infected with the Y virus alone, have never been found to contain inclusion bodies in the leaves, no matter how serious the clinical effects may be.

Plants infected with the Z virus alone, contain no inclusion bodies.

Plants infected with Paracrinkle present a distinct cytological picture, but no inclusion bodies have been observed in their leaves.

Plants suffering from Leaf Roll present a very characteristic cytological picture, but they do not contain inclusion bodies unless there is a concurrent infection with the X virus.

Inclusion bodies in the Solanum family have been described in detail by various authors; those found in the potato are not distinctive. The protein crystalloid bodies described in tobacco mosaic are rarely seen in the potato.

Whilst unprepared to say that the X virus alone in the potato is responsible for the formation of inclusion bodies, we do find that the evidence for their existence apart from this virus entity is limited.

The results of this investigation support the view of Henderson Smith and other workers that the inclusion bodies are made up of aggregated granular particles which arise from the reaction of the virus with the cytoplasm, and do not represent a gross organism, as has been occasionally suggested.

224* SMITH, K. M.

"Filtration of Plant Viruses."

Nature, 1932, **130**, 243.

The results of some filtration studies with the X and Y potato viruses are given. It is shown that the X virus will pass an L₃ and an L₅ Pasteur-Chamberland candle but the Y virus is not filterable through candles. Nevertheless both viruses will pass a collodion membrane of average pore size infinitely smaller than that of the filter candles. This result is probably due to the capacity for absorption possessed by the Y virus.

225* SMITH, K. M.

"Studies on Plant Virus Diseases: XI. Further Experiments with a Ringspot Virus: its Identification with Spotted Wilt of the Tomato."

Ann. Appl. Biol. 1932, **19**, 305.

Further studies upon a ringspot virus are described and its identification with the virus of tomato spotted wilt is proved.

The insect *Thrips tabaci* is shown to be the vector of the virus in England. The host range of the virus has been studied. All the species of Solanaceae tested, twenty in number, were found to be susceptible and in addition the virus has been experimentally transmitted to lupins, dahlias, asters, zinnias, plantains, campanulas, nasturtiums and broad beans. The virus of spotted wilt was found not to pass an L₁ or L₃ Pasteur-Chamberland candle and its viability was lost after 4 hours' ageing *in vitro*.

242* SMITH, K. M.

"Spotted Wilt: an Important Disease of the Tomato."

J. Min. Agric. 1933, **39**, 1097.

An account of the virus disease of the tomato known as spotted wilt is given and a coloured plate is included to aid the grower in the identification of the disease. The Thrips which transmits the virus and the methods of control for the disease are described.

241* SMITH, K. M.

"The Present Status of Plant Virus Research."

Biol. Rev. 1933, **8**, 136.

In this article which is a companion to one previously written, the whole field of plant virus research is reviewed. The chief methods of approach to the problem are described and the results achieved by their application outlined. An extensive bibliography of the literature on plant viruses is included.

WESTON, W. A. R. DILLON

“Notes on Some Aspects of the Apple and Pear Scab Problem.”

This work, illustrated by numerous drawings, is a special unpublished survey containing many original observations and may be consulted in the Library of the School of Agriculture.

WESTON, W. A. R. DILLON

“Notes on Some Aspects of Spray Injury by Winter Washes.”

This is another unpublished survey on the same lines as the above.

243* WESTON, W. A. R. DILLON.

“Sporulation of *Helminthosporium Avenae* in Artificial Culture.”

Nature, 1933, **131**, 435.

Experiments have shown that sporulation of *Helminthosporium avenae* can be induced by irradiating with the light from a quartz mercury-vapour sun lamp ; and also that sporulation will take place if non-sporing cultures are submitted, out of doors, to either strong diffuse light or sunlight.

PLANT PHYSIOLOGY.

228* GARNER, F. H. AND SANDERS, H. G.

“Investigations in Crop Husbandry. I. The Effects of Seed Treatments on the Germination and Yield of Sugar Beet.”

J. Agric. Sci. 1932, **22**, 551.

Sugar-beet seed germinates unsatisfactorily, largely because the true seeds are enclosed in tough woody coats. Experiments have shewn that seed treatments which remove some of the coat are commercially sound, giving extremely good return under dry seeding conditions. Sulphuric acid treatment accelerated and increased germination, giving a greater plant population at harvest which normally led to a larger yield ; increases of up to 2 tons of washed beet per acre were obtained. Milling the seed appeared to give comparable returns, but final judgment on this treatment awaits further trial.

WESTON, W. A. R. DILLON.

“Seed Treatment.”

Husbandry, 1933, **3**, No. 1.

An article stressing the importance of treating cereal seed stocks with appropriate fungicides so that disease shall be prevented. The proprietary mercuric preparations are mentioned.

WESTON, W. A. R. DILLON.

“Dressing Spring Corn.”

Field, 1933, **161**, 431.

SOIL AND MANURES.

255* HANLEY, F.

“Poultry Manure.”

Agric. Prog. 1933, 10, 99.

Various methods of storing, drying and utilising poultry manure are compared. Attention is drawn to a method of kiln-drying, details and costs being given. An attempt is made to estimate the cash value of poultry manure.

258* SALGADO, M. L. M.

“A Study of the Exchangeable Bases of Some East Anglian Soils Derived from the Jurassic and Cretaceous Sediments, with Special Reference to their Marine Origin.”

J. Agric. Sci. 1933, 23, 18.

An account is given of the pH, percentage CaCO_3 , percentage clay and the content of exchangeable bases of various samples of soils from the Oxford, Ampthill, Kimridge and Gault clays. Comparisons are made with samples of these formations from deeper horizons, and in the light of the figures obtained the difficulty of working these soils and the weathering processes giving rise to them are discussed.

[H. H. N.]

SAYCE, R. AND HANLEY, F.

“The Production of Kiln-Dried Poultry Manure.”

J. Min. Agric. 1932, 39, 656.

Describes the drying of poultry manure in a kiln similar to a malt kiln. An estimate is given of the cost of collecting and drying the manure and a suitable disintegrator for grinding the dried product is described. Chemical analyses of typical samples of the dried manure are quoted and compared with average analyses of similar organic fertilisers.

STATISTICS.

248* WISHART, J.

“Interpolation without Printed Differences: Jordan’s and Aitken’s Formulae.”

Math. Gaz. 1932, 16, 14.

A paper read at the Centenary meeting of the British Association in 1931. Attention is called to a new departure in formulae of interpolation, in the use of which the previous preparation of tabular differences is of no advantage to the user. The methods are compared with those in common use.

247* WISHART, J.

“A Note on the Distribution of the Correlation Ratio.”

Biometrika. 1932, 24, 441.

A study is undertaken of one of the distributions reached recently by Fisher, which may be interpreted as that of the multiple correlation coefficient under certain conditions, or of the correlation ratio. Expressions are reached for the probability

integral of the distribution, and for the mean value and variance of the square of the sample correlation ratio. It is shown that the mean and variance tend, in common with the analogous results previously published for the other main distribution, to the corresponding parameters of Fisher's limiting case, as the size of the sample is increased without limit. The general semi-invariant of this limiting distribution is given.

249* WISHART, J. AND BARTLETT, M. S.

"The Distribution of Second Order Moment Statistics in a Normal System."

Proc. Camb. Philos. Soc. 1932, **28**, 455.

The method of the moment generating function is applied to obtain the distribution of the estimated variance, a result which has been known for a long time, and also the distribution of the estimated product moment, likewise a known result. The method adopted is of interest in that it is alternative to the geometrical method of reasoning usually followed.

WISHART, J. AND BARTLETT, M. S.

"The Generalised Product Moment Distribution in a Normal System."

Proc. Camb. Philos. Soc. 1933, **29**, 260.

Following on their previous paper, the authors give a more complete account of the one variable problem. The same method is applied to the bi-variate problem, and then generally to the case of any number of variates. It is shown how the distributions of first order and second order moments are completely independent, and finally, with the aid of an integral evaluated by Ingham, the authors deduce the generalised product moment distribution, previously reached by Wishart by geometrical methods.

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(Issued June, 1929)

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